

**U.S. FISH AND WILDLIFE SERVICE  
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Lysimachia daphnoides*

COMMON NAME: Lehua makanoe

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

**STATUS/ACTION**

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition requesting a reclassification of a listed species?

**FOR PETITIONED CANDIDATE SPECIES:**

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 1999

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- \_\_\_ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- \_\_\_ F – Range is no longer a U.S. territory.
- \_\_\_ I – Insufficient information exists on biological vulnerability and threats to support listing.
- \_\_\_ M – Taxon mistakenly included in past notice of review.
- \_\_\_ N – Taxon does not meet the Act’s definition of “species.”
- \_\_\_ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Myrsinaceae (Myrsine family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

LAND OWNERSHIP: All of the currently known populations are found on State-owned lands.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul\_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa\_russell@fws.gov

#### BIOLOGICAL INFORMATION:

Species Description *Lysimachia daphnoides* is a small shrub forming clumps 2 to 5 decimeters (0.7 to 1.6 feet (ft)) tall, with several stems and reddish brown to dark brown bark. Leaves are closely spaced, alternate, and oblong to oblanceolate, 20 to 53 millimeters (mm) (0.8 to 2 inches (in)) long, and 6 to 14 mm (0.2 to 0.6 in) wide. Flowers are solitary in the leaf axils, six- to seven-merous, with a dark purple or dark burgundy, and campanulate corolla. Capsules are subglobose and seeds are dark brown and 2 mm (0.08 in) long (Wagner *et al.* 1999a).

Taxonomy *Lysimachia daphnoides* was originally described as a variety of *L. hillebrandii* by A. Gray and later recognized by Hillebrand as a full species. This species is recognized as a distinct taxon in Wagner *et al.* (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy. In the 2003 supplement to the *Manual of the Flowering Plants of Hawaii*, this genus has been moved from the Primulaceae to the Myrsinaceae family (Wagner and Herbst 2003).

Habitat *Lysimachia daphnoides* is found in bogs at elevations between 1,220 and 1,570 m (4,003 and 5,151 ft) (Wagner *et al.* 1999a).

Historical and Current Range/Current Status This species is known from nine populations totaling 180 to 300 individuals in the Alakai area of the island of Kauai (Steve Perlman, National Tropical Botanical Garden, pers. comm. 1996). Due to inclement weather, staff of the U.S. Fish and Wildlife Service (Service) and the Hawaii Division of Forestry and Wildlife have only been able to conduct intermittent biannual monitoring of this species. However, we have monitored the populations within three fenced bogs over the last four years and the number of individuals has fluctuated very little, although no recruitment has been observed (Marie Bruegmann, Service, pers. comms. 2004 and 2005; Service Kauai bog monitoring database 2005).

#### THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

*Lysimachia daphnoides* is threatened by feral pigs (*Sus scrofa*) that degrade and destroy habitat (S. Perlman, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on Kauai. Pigs are currently present on Kauai and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999a). Pig exclusion fences protect three of the nine known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

This species is threatened by trampling from hikers along the Alakai Swamp trail (S. Perlman, pers. comm. 1996). A boardwalk was constructed in the 1990s to alleviate this impact, and has been somewhat successful, although people still jump from the boardwalk into the large mud holes along the trail and may damage *Lysimachia daphnoides* (M. Bruegmann, pers. comm. 2005).

C. Disease or predation.

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Therefore, even though there are no observations of browsing for this species, it is likely that pigs impact this species directly as well as their indirect impacts to the surrounding habitat.

In addition, no viable seeds have been observed due to damage to fruits from a boring insect.

This insect has not yet been identified, and may be a native species (M. Bruegmann, pers. comm. 2004).

D. The inadequacy of existing regulatory mechanisms.

The Forest Reserve Act of 1903 was an important action that protected watersheds in Hawaii. This act has been strengthened and re-titled Hawaii Department of Land and Natural Resources Title 13, Chapter 104 Rules Regulating Activities within Forest Reserves and provides protection to native forest values from certain degrading factors caused by human activities. The Hawaii Department of Land and Natural Resources Regulation (Administrative Rule No. 1, Chapter 3) established the 4,022 hectare (9,939 acres) Alakai Wilderness Preserve in 1964, recognizing the pristine forest values of that area and the need to control potential degrading factors. No funding was obligated along with this law to allow Hawaii Department of Land and Natural Resources to adequately manage the area.

Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Lands and Natural Resources n.d.-a, n.d. b, n.d.-c, n.d.-d). Hunting is allowed within the Alakai Wilderness, but because of its remoteness and rugged topography, little public hunting is done in the areas where this species occurs. Pig exclusion fences protect three of the nine known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.

While there are some nonnative plant species in the bog habitat, additional nonnative species are encroaching into this habitat and their numbers will continue to increase if the fenced areas are not actively managed (Perlman and Wood 1995). *Juncus planifolius* (no common name) is a perennial rush which has naturalized in moist, open, disturbed depressions on margins of forests and in bogs on Kauai, Oahu, Molokai, Maui, and Hawaii (Coffey 1990). *Juncus planifolius* is only found in disturbed areas, so the removal of feral pigs will most likely stem the spread of this species (Perlman and Wood 1995; S. Perlman, pers. comm. 1997). *Andropogon virginicus* (broomsedge) is a perennial, tufted grass, which is naturalized on Kauai, Oahu, and Hawaii along roadsides and in disturbed dry to mesic forest and shrubland (Clyde Imada, Bernice Pauahi Bishop Museum, pers. comm. 1997; O'Connor 1990). The saturation of soil in the bogs creates a lack of oxygen, which inhibits the uptake of water by plant roots, resulting in drought conditions (Joan Canfield, Service, pers. comm. 1996). Broomsedge is beginning to establish in the bogs of the Alakai that are most easily accessible to humans and may become a threat to *Lysimachia daphnoides* if disturbance to the bogs continues (Perlman and Wood 1995).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Confirmed personal observations (Perlman and Wood 1995) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *L. daphnoides*. Competition

may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the bog habitat of *L. daphnoides*, the Service believes nonnative plant species are a threat to this species. Nonnative plants are being controlled in three of the nine known populations of this species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Many widespread alien taxa cannot be completely eradicated from Kauai, and therefore are expected to continue dispersing into previously managed areas (Loope 1998, Smith 1985). The remaining unmanaged populations of *L. daphnoides* are still impacted by this threat.

#### CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service, working in cooperation with the State of Hawaii, Division of Forestry and Wildlife, has fenced three of the bogs in which *Lysimachia daphnoides* currently occurs. Funding was made available from the Service's Portland Regional Office in fiscal year 1995 to begin this work, and the Service and the Hawaii Division of Forestry and Wildlife have conducted intermittent biannual weeding and monitoring since then. Additional funding will be required for annual fence maintenance, monitoring and weed control.

#### SUMMARY OF THREATS:

The greatest threat to this taxon at this time is the lack of regeneration. Two other major threats to this species include feral pigs and nonnative plants. Feral pigs have been fenced out of three of the nine populations where *Lysimachia daphnoides* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the three populations that are fenced. These on-going conservation efforts for this species benefit only three of the nine known populations. The unmanaged populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

#### LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
<b>High</b>	<b>Imminent</b>	Monotypic genus	1
		<b>Species</b>	<b>2*</b>
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5

		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

**Rationale for listing priority number:**

*Magnitude:*

This species is highly threatened by feral pigs that degrade and destroy habitat, by hikers that may trample individuals, and by nonnative plants that outcompete and displace it. Threats to montane bog habitat of *Lysimachia daphnoides* and to individuals of this species occur throughout its range, and are expected to continue or increase without control or eradication. In addition, regeneration is not occurring due to an unknown invertebrate that eats most, if not all, of the seeds in the fruit. Feral pigs have been fenced out of three of the nine current populations of *Lysimachia daphnoides* but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the three populations that are fenced. These on-going conservation efforts for this species benefit only three of the nine known populations. The other six populations are still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

*Imminence:*

Threats to *Lysimachia daphnoides* from pigs, hikers, and nonnative plants are imminent because they are ongoing in the six unfenced populations.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the Service, working in cooperation with the State of Hawaii, Division of Forestry and Wildlife, has fenced three of the bogs in which *Lysimachia daphnoides* currently occurs, which benefit individuals of this species. The Service and the Division of Forestry and Wildlife conduct intermittent biannual weeding and monitoring of these fenced areas since 1995. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *L. daphnoides* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

**DESCRIPTION OF MONITORING:**

Much of the information in this form is based on the results of a meeting of 20 botanical experts

held by the Center for Plant Conservation in December of 1995, and was updated with information from a 1995 survey of Kauai bogs by the National Tropical Botanical Garden. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. In 2005 we contacted the species experts listed below. Confirmation of the status of *Lysimachia daphnoides* was provided by Marie Brueggmann, Service in 2004 and 2005.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al.* (1999b).

This level of monitoring is appropriate to update the status of the species, since the populations are monitored in detail one to two times a year by the Service and the Hawaii Division of Forestry and Wildlife. The results of this on-the-ground monitoring are included in this assessment.

#### COORDINATION WITH STATES:

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

#### LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood	June 28, 2005	National Tropical Botanical Garden
10. Marie Brueggmann*	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway*	June 14, 2005	Hawaii Division of Forestry and Wildlife

\*Provided new information in 2005

List all databases searched:

Name	Date
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1. Hawaii Natural Heritage Program 2004
2. U.S. Fish and Wildlife Service Kauai bog monitoring database 2005

Other resources utilized:

- Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.
- Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.
- Coffey, J.C. 1999. Juncaceae: *In* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawai'i. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Mus. Spec. Publ. 97: 1451-1455.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.
- Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai'i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.
- Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
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- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
- Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

- Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. *Weed Technology* 18: 1472-1474.
- Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvenscens* DC (Melastomataceae) in the Hawaiian Islands. *Bishop Mus. Occas. Pap.* 48: 23-36.
- Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. *American Fern Journal* 82: 27-33.
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- Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvenscens* D.C. (Melastomataceae). *Journal of Biogeography* 23: 775-781.
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- Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. *Studies in Avian Biology* 9:1-429. Cooper Ornithological Society, Los Angeles.
- Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai'i. *Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park*, pp. 274-288.
- Smith, C.W. 1985. Impact of alien plants on Hawai'i's native biota: *In* Stone, C.P., and J.M. Scott (eds.), Hawai'i's terrestrial ecosystems: preservation and management. *Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu*, pp. 180-250.
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- Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. *Bishop Mus. Occas. Pap.* 60: 1-58.
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of Hawai'i, version 3.1. December 12, 2003. Available from the Internet. URL:  
<http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm>.  
Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National  
Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: **Acting** David W. Winkler 11/18/05  
Regional Director, Fish and Wildlife Service Date

Marshall P. Jones

Concur: \_\_\_\_\_ August 23, 2006  
Director, Fish and Wildlife Service Date

Do not concur: \_\_\_\_\_  
Director, Fish and Wildlife Service Date

Date of annual review: September 20, 2005  
Conducted by: Marie M. Brueggemann, Pacific Islands FWO  
Plant Recovery Coordinator

Comments:  
PIFWO Review

Reviewed by: Christa Russell Date: September 23, 2005  
Plant Conservation Program Leader

Gina Shultz Date: October 14, 2005  
Assistant Field Supervisor,  
Endangered Species

Patrick Leonard Date: October 14, 2005  
Field Supervisor